

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FORAGE HARVEST MANAGEMENT

(Acre)

CODE 511

DEFINITION

The timely cutting and removal of forages from the field as hay, green-chop, or ensilage.

PURPOSES

- Optimize yield and quality of forage at the desired levels
- Promote vigorous plant regrowth
- Maintain stand life
- Manage for the desired species composition
- Use forage plant biomass as a soil nutrient uptake tool
- Control insects, diseases and weeds
- Maintain and/or improve wildlife habitat

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses (cropland, hayland, pastureland, rangeland) where machine harvested forage crops are grown.

CRITERIA

General criteria applicable to all purposes

Forage will be harvested at a frequency and height that will maintain a desired healthy plant community. State Cooperative Extension Service (CES) forage harvest recommendations based on state of maturity, moisture content, length of cut,

stubble height and harvest interval should be used to meet the following criteria.

Forage stands weakened by adverse weather/site conditions, or by overgrazing or too frequent cuttings shall be deferred from use until signs of stress are gone.

Stage of Maturity. Harvest forage at the stage of maturity that provides the desired quality and quantity, and will allow for adequate regrowth. Adequate regrowth prior to the first killing frost will insure adequate food storage for spring growth, and prevent winter injury. See Table 1.

Delay harvest if prolonged or heavy precipitation is forecast that would seriously damage cut forage.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

If the land is also grazed, then Prescribed Grazing (528A), Conservation Practice Standard, Section IV, FOTG will be a part of the Conservation Management System.

Moisture Content. Harvest silage/haylage crops within the optimum moisture range for the type of storage structure(s) being utilized. Refer to Table 2.

Treat direct cut hay crop silage (moisture content > 70%) with chemical preservatives or add dry feed stuffs to avoid fermentation and seepage digestible dry matter losses.

For optimal dry hay quality, rake hay at 30-40 percent of moisture and invert swaths when moisture is above 40 percent. Bale when hay has sufficient moisture to prevent leaf loss.

Length of cut. When harvested for ensilage, forage will be chopped to a size appropriate for type of storage structure (high moisture wrapped or tubed bales) that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process.

Contaminants. Forage shall not contain contaminants that can cause illness or death to the animal being fed or rejection of the offered forage.

Additional Criteria to Improve or Maintain Stand Life, Plant Vigor, and Forage Species Mix

Stage of Maturity and Harvest Interval. Cut forage plants at a stage of maturity or harvest interval range that will provide adequate food reserves and/or basal or auxiliary tillers or buds for regrowth and/or reproduction to occur without loss of plant vigor.

Harvest management is the primary method by which managers can influence the nutritional quality of forage, as well as forage yield and stand life. For alfalfa, total yields will continue to increase past the bud stage, however, crude protein and total digestible nutrients decline rapidly, as most of the additional biomass is stem material. Carbohydrate content of roots continues to increase up until about full bloom, allowing the plant to regrow following harvest. Managers need to be aware of stand longevity versus forage digestibility, and balance their animal feed needs with their crop rotation.

Cut reseeding annuals at a stage of maturity and frequency that ensures the production of viable seed or ample carryover of hard

seed to maintain desired stand density. The specified number of harvests per year shall be based on the forage's ability to regrow after defoliation by cuttings, its growth rate response to environmental conditions, its end of season minimum stubble height and food reserve requirements, and the length of the growing season.

Rangelands with range sites that receive supplemental moisture may be harvested once a year. All other rangeland sites should be harvested no more than every other year to allow adequate plant recovery. Limit grazing harvested sites to the dormant season in both the harvest and the following year.

If plants show signs of short-term environmental stress, management will be applied in a manner that encourages the continued health and vigor of the stand.

Stubble Height. Cut forage plants at a height that will promote the vigor and health of the desired species. Cutting heights will provide adequate residual leaf area (photosynthetic area); adequate numbers of terminal, basal, or auxiliary tillers or buds and stolons and rhizomes; insulation from extreme heat or cold; and/or unsevered stem bases that store food reserves needed for full, vigorous recovery.

Manipulate timing and cutting heights of harvest to ensure germination and establishment of reseeding or seeded annuals. See Table 1.

Additional Criteria To Use as a Nutrient Uptake Tool

Employ a harvest regime that utilizes the maximum amount of available or targeted nutrients. All applications of nutrients will conform to Nutrient Management (590), Conservation Practice Standard, Section IV, FOTG.

Additional Criteria to Control Disease, Insect, and Weed and Invasive Plant Infestations

Schedule harvest periods to control disease, insect, and weed infestations. When a pesticide is used to control disease, insects, or weeds, adhere to the specified days to harvest period stated on the pesticide label. All applications of pesticides will conform to Pesticide Management (595), Conservation Practice Standard, Section IV, FOTG.

Lessen incidence of disease, insect damage, and weed infestation by managing for desirable plant vigor. Plan and schedule the removal of invasive plants.

Additional Criteria to Improve Wildlife Habitat Values

If client objectives include providing suitable habitat for desired wildlife species(s) then appropriate harvest schedule(s), cover patterns, and plant height to provide suitable habitat for the desired specie(s) should be maintained.

CONSIDERATIONS

When pastures produce forage in excess of livestock demand during high growth rate periods, consider preserving forage quality by machine harvesting a portion of the standing crop. Coordinate this practice with the Prescribed Grazing (528), Conservation Practice Standard, Section IV, FOTG. Also consider stockpiling excess forage as standing plant material to be utilized later in the year as grazed forage.

Well-fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. For specific nutrient uptake, select species that can maximize nutrient uptake. An excess or improper balance of nutrients such as nitrogen or potassium can produce plant material that causes toxicity in some animals. Coordinate this practice with the

Nutrient Management (590), Conservation Practice Standard, Section IV, FOTG.

Select cultivars that are suitable for the harvest regime, species mix, and forage quality desired. See Pasture and Hay Planting (512) Conservation Practice Standard, Section IV, FOTG and WY Plant Materials Technical Note #3 for adapted species, seeding rates, recommended varieties/cultivars and seeding dates.

When insect and disease outbreaks exceed economic thresholds and are uncontrollable by harvest management, pesticide applications may be needed. Consider planting resistant varieties or rotating to annual crops. Refer to Pesticide Management (595), Conservation Practice Standard, Section IV, FOTG.

To control forage plant diseases, insects, and weeds, clean harvesting equipment after harvest and before storing. Do not cut forages until dew, rain, or irrigation water on leaves has evaporated.

When weed infestation exceeds the economic threshold and is uncontrollable by forage harvest management alone, weed management should be planned and applied.

Care should be taken to produce stored forages of the quality needed for optimum performance of the animal being fed. For instance, immature legume forages can be too low in fiber and lead to metabolic disorders in ruminants and an economic loss to the producer due to lowered animal performance.

Direct cut grass and legume silage can create silage leachate (seepage). Consider the collection, storage, and disposal of this leachate as part of an agricultural waste management system.

In conjunction with harvest options, explore storage and feeding options that will retain acceptable forage quality and minimize digestible dry matter loss. Also consider storage location for large square or round bales/balage with regards to inside vs.

outside, along wind breaks, winter/mud considerations, etc.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

Where may cause unacceptable forage quality losses, consider ensiling, greenchopping or grazing to reduce or eliminate field-drying time. Other options are the use of desiccants, preservatives, or conditioners, to reduce field drying time. These techniques can improve the timeliness of harvest and preserve forage quality.

To reduce safety hazard, avoid operating harvesting and hauling equipment on field slopes over 25 percent, particularly on cross slope traffic patterns.

PLANS AND SPECIFICATIONS

Plans and Specifications shall be prepared for each site or management unit according to the Criteria, Considerations, and Operations and Maintenance described in this standard, and shall be recorded on specification/jobsheets, in narrative statements in the conservation plan, or other acceptable documentation.

A forage harvest management plan will include the following information:

- Field numbers and acres with map
- Stage and/or timing of harvest
- Minimum stubble heights
- Method(s) of harvest and/or processing
- Harvest management information
- Other pertinent management information.
- The crop rotation or percentage of each crop in the rotation will be stated for hayland

OPERATION AND MAINTENANCE

Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock, lead to sickness (for example, hardware disease) or death.

Monitor weather conditions and take action accordingly before and after cutting to optimize forage wilting or curing time to preserve feed quality and prevent forage swaths or windrows from smothering underlying plants.

Inspect and repair harvesting equipment prior to harvest season to reduce downtime during the season. All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working on or unplugging moving parts. following manufacturer's preventative maintenance procedures.

Operate all forage harvesting equipment at the optimum settings and speeds to minimize loss of leaves.

Set shear-plate on forage chopper to the proper theoretical cut for the crop being harvested. Keep knives well sharpened. Do not use recutters or screens unless forage moisture levels fall below recommended levels for optimum chopping action.

Regardless of silage/haylage storage method, ensure good compaction and an airtight seal to exclude oxygen and mold formation.

REFERENCES:

- Ball, D. M., C. S. Hoveland, & G. D. Lacefield. Southern Forages. 1991. Potash & Phosphate Institute, Norcross, GA.
- Barnes, R. F., D. A. Miller, & C. J. Nelson. Forages, The Science of Grassland Agriculture, Fifth Edition. 1995. Iowa State University Press, Ames, IA.
- Hanson, A. A., D. K. Barnes, & R. R. Hill, Jr. Alfalfa and Alfalfa Improvement. 1988.

American Society of Agronomy, Madison, WI.

Ishler, V. A. Et al. Harvesting and Utilizing Silage. 1991. Penn State University Circular 396. University Park, PA.

Matches, A. G. Anti-Quality Components of Forages. 1973. Crop Science Society of America Special Pub. No. 4, Madison, WI

Pitt, R. E. Silage and Hay Preservation. 1990. Northeast Regional Agricultural Engineering Service. Ithaca, NY.

Serotkin, N., Ed. The Penn State Agronomy Guide, 1995-1996. Pennsylvania State University. 1994. University Park, PA.

Smith, D. Forage Management in the North, Third Edition. 1975. Kendall/Hunt Publishing Company, Dubuque, IA.

Taylor, N. L. Clover Science and Technology. 1985. American Society of Agronomy, Madison, WI.

University of California, Intermountain Alfalfa Management, Publication No. 3366.

511 - FORAGE HARVEST MANAGEMENT

Table 1

Approximate growth stage, cutting height (inches), and minimum leaf length (inches), before killing frost.

SPECIES	CUTTING	GROWTH STAGE	CUTTING HEIGHT	REGROWTH BY FROST
GRASSES:				
Bluegrass, big	1 st , 2 nd	Boot to pre-head	3	8
Bluegrass, Kentucky	1 st , 2 nd	Boot to early head	3	3
Bromegrass, smooth	1 st = 2 nd =	Heading to flowering When 12-15" tall	3	4
Bromegrass, meadow	1 st , 2 nd	Boot to early head	3	4
Canarygrass, Reed	1 st = 2 nd =	1 st head to flower When 12-15" tall	3	8
Fescue, tall ¹	1 st , 2 nd	Boot to pre-head	3	5
Foxtail, creeping	1 st , 2 nd	Boot to early head	3	5
Foxtail, meadow	1 st , 2 nd	Boot to early head	3	5
Needlegrass, green	1 st , 2 nd	Boot to early head	3	5
Orchardgrass	1 st = 2 nd =	Heading to flowering When 10 – 12" tall	3	6
Timothy	1 st = 2 nd =	Heading to flowering When 12 – 15" tall	3	6
Wheatgrass, beardless	1 st , 2 nd	Boot to early head	3	7
Wheatgrass, bluebunch	1 st , 2 nd	Boot to early head	3	7
Wheatgrass, crested	1 st , 2 nd	Boot to early head	3	3
Wheatgrass, Fairway	1 st , 2 nd	Boot to early head	3	2
Wheatgrass, Fairway x standard	1 st , 2 nd	Boot to early head	3	3
Wheatgrass, intermediate	1 st , 2 nd	Boot to early head	3	7
Wheatgrass, pubescent	1 st , 2 nd	Boot to early head	3	7
Wheatgrass, Siberian	1 st , 2 nd	Boot to early head	3	3
Wheatgrass, slender	1 st , 2 nd	Boot to early head	3	6
Wheatgrass, streambank	1 st , 2 nd	Boot to early head	3	3
Wheatgrass, tall	1 st , 2 nd	Boot to early head	5	8
Wheatgrass, thickspike	1 st , 2 nd	Boot to early head	3	4
Wheatgrass, western	1 st , 2 nd	Boot to early head	3	4
Wildrye, Altai	1 st , 2 nd	Boot to early head	3	-
Wildrye, beardless	1 st , 2 nd	Boot to early head	3	-
Wildrye, Russian	1 st , 2 nd	Boot to early head	3	4

1 – Avoid harvest of tall fescue seedheads to minimize endophyte toxicity problems.

SPECIES	CUTTING	GROWTH STAGE	CUTTING HEIGHT	REGROWTH BY FROST
LEGUMES:				
Alfalfa	1 st , 2 nd	Mid-bud to 1/10 th bloom	2	7
Clover, alsike	1 st = 2 nd =	Late bud to 1/4 th bloom When 10 – 12" tall ²	2	6
Clover, ladino	1 st = 2 nd =	Late bud to 1/4 th bloom When 10 – 12" tall	2	6
Clover, red	1 st = 2 nd =	Late bud to 1/4 th bloom When 10 – 12" tall	2	6
Clover, white	1 st = 2 nd =	Late bud to 1/4 th bloom When 10 – 12" tall	2	6
Milkvetch, cicer	1 st = 2 nd =	1/10 th bloom End of season	2	5
Sainfoin	All	½ bloom	2	6
Sweetclovers	All	1 st to full bloom ³	2	4
Trefoil, birdsfoot	1 st = 2 nd =	Early bloom After 6-8 weeks	2	5
Vetch, hairy	No info.			
OTHER:				
Small grains	All	Late milk to soft dough	3	-
Grass – legume mix	All	Base on legume	-	-

2 – Many clovers have moisture contents that limit their usefulness as hay.

3 – Sweetclover hay with a moisture content > 50% can readily mold, become toxic, and cause hemorrhagic disease in cattle.

Table 2
Recommended

FORAGE PROCESSING METHOD	PERCENT MOISTURE for PROCESSING
Cubes	10-14%
Small Rectangular Bales	12-15%
With Preservative	18-20%
Large Square Bales	12-15%
Large Round Bales	12-15%
Hay Loaves	15-20%
Haylage/Silage	50-80%